

**In the Claims**

Please replace all prior versions of claims in the application with the following claims:

1. (Currently Amended) A cathode sub-assembly for [[a]] an ion source comprising:  
an indirectly heated cathode having an outer periphery and an interior area; and  
a support rod fixedly attached to the interior area of the indirectly heated cathode for supporting the cathode ~~with~~ within an arc chamber of the ion source and avoiding gas introduction and high pressure near the support rod.
2. (Original) The cathode sub-assembly as defined in claim 1 wherein the support rod is attached to a surface of the cathode facing away from the arc chamber.
3. (Original) The cathode sub-assembly as defined in claim 2 wherein the cathode is in the shape of a disk.
4. (Original) The cathode sub-assembly as defined in claim 3 wherein the support rod is fixedly attached at or near the center of the cathode, along an axis of the cathode.
5. (Original) The cathode sub-assembly as defined in claim 4 wherein the support rod is in the shape of a cylinder and the diameter of the cathode is larger than a diameter of the support rod.
6. (Original) The cathode sub-assembly as defined in claim 5 wherein the diameter of the cathode is at least four times larger than the diameter of the support rod.
7. (Original) The cathode sub-assembly as defined in claim 5 further comprising a spring loaded clamp for holding the support rod.

8. (Original) The cathode sub-assembly as defined in claim 1 wherein the support rod mechanically supports and conducts electrical energy to the cathode.

9. (Currently Amended) A cathode sub-assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode having an outer periphery and an interior area and a support rod fixedly mounted to the interior area of the cathode ~~thereto~~ which avoids gas introduction and high pressure near the support rod;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and

a cathode insulator for electrically and thermally isolating the cathode from ~~an~~ the arc chamber housing, that is disposed around the cathode of the cathode sub-assembly.

10. (Currently Amended) The cathode assembly as defined in claim 9 ~~further comprising a~~ wherein the filament is disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber.

11. (Currently Amended) The cathode assembly as defined in claim 9 ~~further comprising a~~ wherein the filament is disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod.

12. (Currently Amended) A cathode assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode having an outer periphery and an interior area and a support rod fixedly mounted to the interior area of the cathode ~~thereto~~;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and

a cathode insulator for electrically and thermally isolating the cathode from ~~an~~ the arc chamber housing, that is disposed around the cathode of the cathode sub-assembly; ~~and~~

~~a-wherein the~~ filament is disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod, and wherein a cross-sectional area of the filament varies along a length of the filament, and is smallest along the arc-shaped turn.

13. (Currently Amended) A cathode assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode having an outer periphery and an interior area and a support rod fixedly mounted to the interior area of the cathode ~~thereto~~ which avoids gas introduction and high pressure near the support rod;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and

a cathode insulator for electrically and thermally isolating the cathode from ~~an~~ the arc chamber housing, that is disposed around the cathode of the cathode sub-assembly;

wherein said cathode insulator includes an opening having a diameter that is larger than or equal to the diameter of the cathode.

14. (Original) The cathode assembly as defined in claim 13 wherein a vacuum gap is provided between the cathode insulator and the cathode to limit thermal conduction.

15. (Previously presented) The cathode assembly of claim 13 wherein said cathode insulator has a generally tubular shape with a sidewall and includes a flange, for shielding the sidewall of the cathode insulator from a plasma in the arc chamber.

16. (Previously presented) The cathode assembly of claim 15 wherein said flange is provided with a groove on a side of the flange facing away from the plasma, for increasing a path length between the cathode and the arc chamber housing.

17. (Currently Amended) A method for supporting and indirectly heating a cathode of an ion source comprising ~~steps of~~:

supporting the cathode having an outer periphery and an interior area by a rod fixedly attached to the interior area of the cathode which avoids gas introduction and high pressure near the rod; and  
bombarding the cathode with electrons.

18. (Currently Amended) A cathode assembly for an ion source comprising:

a cathode having an outer periphery and an interior area;  
a support rod fixedly attached to the interior area of the cathode which avoids gas introduction and high pressure near the support rod;  
a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing; and  
an indirect heating device for indirectly heating the cathode.

19. (Previously Presented) The cathode sub-assembly as defined in claim 1 wherein the support rod is press fitted to the indirectly heated cathode.

20. (Previously Presented) The cathode assembly as defined in claim 9 wherein the support rod is press fitted to the cathode.

21. (Previously Presented) The cathode assembly as defined in claim 12 wherein the support rod is press fitted to the cathode.

22. (Previously Presented) The cathode assembly as defined in claim 13 wherein the support rod is press fitted to the cathode.

23. (Previously Presented) The method as defined in claim 17 wherein the step of supporting comprises press fitting the rod to the cathode.

24. (Previously Presented) The cathode assembly as defined in claim 18 wherein the support rod is press fitted to the cathode.

25. (Currently Amended) A cathode sub-assembly for an ion source comprising:

an indirectly heated cathode having an outer periphery and an interior area; and  
a support rod press fitted to the interior area of the indirectly heated cathode for  
supporting the cathode within an arc chamber of the ion source which avoids gas  
introduction and high pressure near the support rod.